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they are part and parcel of our circumstances. To estimate the work of the Observatory rightly, they must be taken into account. I may safely leave it for others to say that they have by no means dismayed our company of astronomers, but that they rather have incited them to new efforts. I shall be glad to have indicated, even thus summarily, a few of the directions in which the Observatory needs and deserves to be helped. If our wants are once known, I feel sure that they will be remedied.

A MECHANICAL THEORY OF THE SOLAR CORONA.

By J. M. SCHAEBERLE.

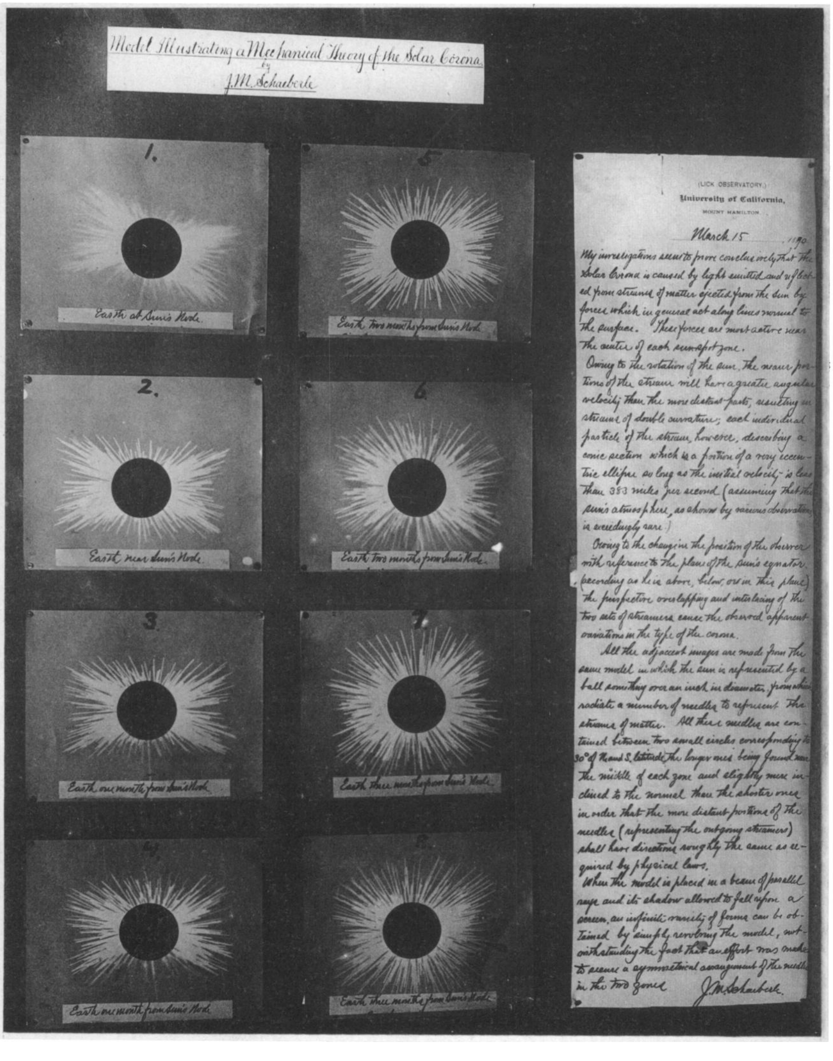
[ABSTRACT.]

Mr. SCHAEBERLE presented a paper entitled "A Mechanical Theory of the Solar Corona." He stated that his investigations seemed to prove conclusively that the solar corona is caused by light emitted and reflected from streams of matter ejected from the sun, by forces which, in general, act along lines normal to the surface of the sun; these forces are most active near the centre of each sun-spot zone.

Owing to the rotation of the sun, the streams of matter will not lie along normals, since the angular velocity of different portions of the stream grows less as the distance from the sun increases; in other words, the streams are of double curvature. Each individual particle of the stream, however, describes a portion of a conic section, which is a very elongated ellipse so long as the initial velocity is less than 383 miles per second (assuming that the sun's atmosphere, as shown by various observations, is exceedingly rare).

The variations in the type of the corona admit of an exceedingly simple explanation, being due to nothing more than the change in the position of the observer with reference to the plane of the sun's equator. *According as the observer is above, below, or in the plane of the sun's equator, the perspective overlapping and interlacing of the two sets of streamers cause the observed apparent variations in the type of the corona.*

Mr. SCHAEBERLE then exhibited a model, in which the sun is represented by a ball about an inch in diameter, from which radiate a number of needles, to represent the streams of matter. All these needles are contained between two zones corresponding to ± 30° of



Model Illustrating a Mechanical Theory of the Solar Corona
by
J. M. Schaeberle

1.
Earth at Sun's Node
5
Earth two months from Sun's Node
2.
Earth near Sun's Node
6.
Earth two months from Sun's Node
3.
Earth one month from Sun's Node
7
Earth three months from Sun's Node
4.
Earth one month from Sun's Node
8.
Earth three months from Sun's Node

(LICK OBSERVATORY.)
University of California,
MOUNT HAMILTON

March 15, 1890

My investigations seem to prove conclusively that the Solar Corona is caused by light emitted and reflected from streams of matter ejected from the sun by forces which in general act along lines normal to the surface. These forces are most active near the center of each sunspot zone.

Owing to the rotation of the sun, the nearer portions of the stream will have a greater angular velocity than the more distant parts, resulting in streams of double curvature; each individual particle of the stream, however, describing a conic section which is a portion of a very eccentric ellipse so long as the initial velocity is less than 383 miles per second (assuming that the sun's atmosphere, as shown by various observations, is exceedingly rare.)

Owing to the change in the position of the observer with reference to the plane of the sun's equator (according as he is above, below, or in this plane) the perspective overlapping and interlacing of the two sets of streamers cause the observed apparent variations in the type of the corona.

All the adjacent images are made from the same model in which the sun is represented by a ball something over an inch in diameter, from which radiate a number of needles to represent the streams of matter. All these needles are contained between two small circles corresponding to 30° of N and S. latitude, the longer ones being found near the middle of each zone and slightly more inclined to the normal than the shorter ones in order that the more distant portions of the needles (representing the outgoing streamers) shall have directions roughly the same as required by physical laws.

When the model is placed in a beam of parallel rays and its shadow allowed to fall upon a screen, an infinite variety of forms can be obtained by simply revolving the model, notwithstanding the fact that an effort was made to secure a symmetrical arrangement of the needles in the two zones

J. M. Schaeberle.

latitude. The longer ones are most numerous near the middle of each zone, and slightly more inclined to the normal than the shorter ones, in order that the more distant portions of the needles (representing the outgoing streams) shall have directions roughly the same as required by physical laws. Eight photographs of the model, representing the various types of the corona, were also shown. When the model is placed in a beam of parallel rays and its shadow allowed to fall upon a screen, the slightest change in the position of the model produces an entirely new image. Mr. SCHAEBERLE stated that he had thus far been unable to find a single observed phenomenon which could not be accounted for by this mechanical theory.

A discussion of the theory and a comparison, showing the remarkable agreement with observation, will appear in the Report of the Eclipse of December 21, 1889.

PHOTOMETRY OF THE CORONA OF DECEMBER, 1889.

By EDWARD S. HOLDEN.

[ABSTRACT.]

Mr. HOLDEN gave an account of the photometric determinations of the actinic brightness of the corona. Two of the plates taken by Mr. BURNHAM and two taken by Mr. SCHAEBERLE were standardized. A preliminary reduction of these plates shows that the brightness of the corona and sky, as measured directly from the plates, will substantially reproduce the results obtained by Mr. W. H. PICKERING at the eclipse of 1886, in Grenada. That is, the brightness of the corona, as measured directly from the plates, will be only about 40 *per cent.* of that obtained from Mr. BARNARD's plates of the California eclipse of January 1, 1889. Mr. PICKERING's plates of 1886 were not developed for several months after the eclipse, and when developed the films were found to have deteriorated. The Cayenne plates showed considerable deterioration, due to dampness, though they were developed immediately after exposure. Precautions were, however, taken, before the eclipse, which will possibly enable us to give a numerical estimate of the amount of change. Besides the eclipse plates ten others (A, B, C, D, E, F, G, H, I, J), were standardized by Mr. BARNARD at the Lick Observatory, on September 24, 1889. A, B, C, D were taken to the eclipse, and E, F, G, H, I, J remained at the Lick Observatory. I and J were